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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/766,739
Filing Date: January 29, 2004
Appellant(s): ABE, KAZUHIDE

Andrew J. Telesz
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 13 August 2007 appealing from the Office action mailed 10 January 2007.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The amendment after final rejection filed on 10 April 2007 has been entered.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

6380084	Lim et al.	4-2002
6342444	Higashi et al.	1-2002
6958291	Yu et al.	11-2005

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims **12-15 and 33** are rejected under 35 U.S.C. 103(a) as being unpatentable over Lim and Higashi.

Regarding claim **12**, Lim discloses in Fig 14 a wiring structure of a semiconductor device, comprising: a first insulating film (72) having plural grooves (Fig 11, one shown in a hillock) formed therein, which has an interface (top surface of 72 around hillock) in the horizontal direction between the adjoining grooves; plural wiring films (84) formed in the grooves of the first insulating film to protrude above the interface; plural barrier films (56, 80), formed on bottoms of the wiring films, and formed on side faces of the wiring films to a height exceeding the interface, wherein the first insulating film has plural protrusions (hillock shown) protruding from the interface, and the grooves are formed in the protrusions, wherein the upper faces of the wiring films and the barrier films are substantially coincident with upper ends of the grooves. Lim fails to specify that the wiring structure includes plural cap films formed at least on upper faces of the wiring

films, which are separated by the grooves and have substantially the same shape as uppermost faces of the protrusions.

Higashi teaches that a cap film may be selectively formed only on wiring in order to reduce the capacitance (col 3 ln 8-18) and wiring resistance. It would have been obvious to one of ordinary skill in the art at the time of the invention to use the teachings of Higashi on the device of Lim to reduce the capacitance and wiring resistance. The resulting structure of Lim with a selective cap layer on the wiring meets the limitation wherein cap films are formed on upper faces of the wiring films and have substantially the shape as uppermost faces of the protrusions.

The claim language "wherein the protrusions are formed through etching the first insulating film, using the cap films as a mask" describes a product by process. See MPEP 2113. "[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." In re Thorpe, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). The resulting structure is a wiring film formed in a groove of a protrusion, and a cap film on the wiring film.

Regarding claims **13-15 and 33**, Higashi discloses in column 4 lines 47-52 the structure of claim 12 wherein the cap films may be made of TaN, TiN, or WN (tungsten).

Claims **16, 28-32 and 34** are rejected under 35 U.S.C. 103(a) as being unpatentable over Higashi and Lim and further in view of Yu.

Regarding claim **16**, Higashi and Lim disclose the structure of claim 12, but do not specify that the cap films are an insulating film containing Si_xC_y as a principal composition.

Yu teaches that a cap film may be insulating or conductive, and that an insulating cap film may comprise SiC (col 5 ln 29) as a principal composition. It would have been obvious to one of ordinary skill in the art to combine the teachings of Yu and Higashi. One of ordinary skill in the art would have been motivated to look to analogous art teaching alternative suitable or useful passivation or cap films, art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07.

Regarding claims **28 and 32**, Lim discloses in Fig 14 a wiring structure of a semiconductor device, comprising: a first insulating film (72) having plural protrusions (one hillock shown) in which grooves are formed (Fig 11, one shown in a hillock), and which has an interface (top surface of 72 around hillock) in the horizontal direction between the adjoining protrusions; plural wiring films (84) embedded in the grooves on barrier films (56, 80). Lim fails to specify that the wiring structure includes plural first cap films formed on upper faces of the protrusions with substantially the same shape as uppermost faces of the protrusions, and second cap films formed on the first cap films and the first insulating film.

Higashi teaches that a cap film may be selectively formed only on wiring in order to reduce the capacitance (col 3 ln 8-18) and wiring resistance. It would have been obvious to one of ordinary skill in the art at the time of the invention to use the teachings of Higashi on the device of Lim to reduce the capacitance and wiring resistance. The resulting structure of Lim with a selective cap layer on the wiring meets the limitation wherein first cap films are formed on upper faces of the wiring films and have substantially the shape as uppermost faces of the protrusions.

Yu teaches that a second insulating cap film may be formed over a first selectively formed conductive film (col 5 ln 33-36), and that the insulating cap film may comprise SiC (col 5 ln 29) as a principal composition in order to passivate the structure (col 5 ln 25). It would have been obvious to one of ordinary skill in the art to use the teachings of Yu on the structure of Lim and Higashi in order to passivate the wiring structure.

The claim language "wherein the protrusions are formed through etching the first insulating film, using the cap films as a mask" describes a product by process. See MPEP 2113. "[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." In re Thorpe, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). The

resulting structure is a wiring film formed in a groove of a protrusion, and a cap film on the wiring film.

Regarding claims **29-31 and 34**, Higashi discloses in column 4 lines 47-52 the structure of claim 12 wherein the conductive cap films may be made of TaN, TiN, or WN.

(10) Response to Argument

Rejection of Claims 12-15 and 33 under 35 U.S.C. 103(a)

Appellants argue on page 8 that Higashi teaches a cap film that is selectively formed only on wiring in contrast to the language of claim 12 wherein the cap films are formed at least on upper faces of the wiring film and not only on wiring. This argument is not persuasive. Claim 12 recites "plural cap films formed at least on upper faces of the wiring films". This language does not exclude cap films formed only on upper faces of the wiring films and the language is not interpreted to mean that cap films are formed on the wiring and on the protrusion surrounding the wiring.

Appellants argue on page 9 that since the cap film of Higashi is formed only on the wiring and not on the protrusion, there clearly can be no sameness between the shape of the cap film and the shape of the uppermost face of the protrusion. This argument is not persuasive. Lim discloses stripe shaped protrusions, and stripe shaped wiring in trenches within the protrusions (see Lim Fig 14 and col 7 ln 56). Since the cap film taught by Higashi is formed on the wiring, it follows that the cap film will also be stripe shaped and therefore substantially the same shape as the uppermost faces of the protrusions.

Rejection of Claims 16, 28-32 and 34 under 35 U.S.C. 103(a)

Appellants argue on page 12 that Higashi teaches a cap film that is formed on upper faces of the wiring films in contrast to the language of claim 28 wherein there are "cap films formed on upper faces of the protrusions". This argument is not persuasive. Lim discloses wiring within a groove in a protrusion that shares an upper face with the protrusion. A cap layer as taught by Higashi, that is formed on the upper face of the wiring, is also considered to be on upper faces of the protrusions. The claim language does not specify cap films formed in direct contact with the protrusions – and therefore the cap film formed above the interface created by the wiring and protrusion upper face satisfies the limitations claimed.

Appellants argue on page 12 that since the cap film of Higashi is formed only on the wiring and not on the protrusion, there clearly can be no sameness between the shape of the cap film and the shape of the uppermost face of the protrusion. This argument is not persuasive. Lim discloses stripe shaped protrusions, and stripe shaped wiring in trenches within the protrusions (see Lim Fig 14 and col 7 ln 56). Since the cap film taught by Higashi is formed on the wiring, it follows that the cap film will also be stripe shaped and therefore substantially the same shape as the uppermost faces of the protrusions.

Appellants argue on page 13 that it is unclear how the teachings of Yu are applied to the primary teachings. Yu teaches that a second insulating cap film of silicon carbide (SiC) may be formed over a first conductive film to passivate the structure (col 5

ln 25-36). The first conductive cap film on wiring as taught by Higashi can therefore have an additional insulating cap film of SiC formed over it to passivate the structure.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

/J. C. I./

Conferees:

Ricky Mack

Zandra Smith